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Automated Support for After Action Review (AAR) Presentation

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Aptima, Inc.

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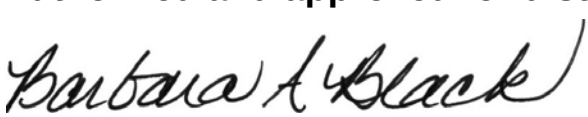

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Although the Army developed the after action review (AAR) for live simulation, it is now applying the process to exercises conducted within virtual environments. Virtual AAR systems provide can significantly facilitate understanding of scenario performance; however, these systems require automated performance assessment capabilities to realize their full potential. We developed Automated Support for AAR Presentation (ASAP), a suite of intelligent technologies designed to enhance virtual AAR systems such as the Dismounted Infantry Virtual After Action Review System (DIVAARS). For this effort, Aptima leveraged its A-Measure product, which provides automated support for authoring, capturing, and synthesizing measures of human performance in simulated environments. The team worked closely with subject matter experts to design a system that enables search and synthesis of simulation-based performance data. Moreover, it organized analytical conclusions into various formats that integrated with AAR systems such as DIVAARS. The resulting toolkit enhanced the capabilities of AAR systems and provided intelligent event recognition and assessment support that extends a human observer's ability to document, understand, and describe scenario-based performance.

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INTRODUCTION

The After Action Review (AAR) is an effective process for presenting performance feedback to teams and trainees following live or virtual collective training exercises. The use of virtual training technology creates unique opportunities for automated and subjective performance measurement collection and calculation. The development of tools that can automatically determine trainee performance through the interpretation of simulator data can provide insight into aspects of performance that are difficult for humans to observe or report reliably. There are other aspects of performance that are more difficult for a system to collect such as adherence to communication protocols or teamwork skills that are better collected by an observer or controller. The goal of the Automated Support for AAR Presentation (ASAP) project was to deliver advances in system-based and observer-based performance measurement, diagnosis, and classification for use in simulation based training.

The ASAP project team was uniquely qualified to conduct this work. The team was composed of research psychologists, software engineers, and military subject matter experts from Aptima, BBN, and MPRI. The team began the effort by selecting a simulation environment and a target domain for the scenario and exercise. A training needs analysis workshop was conducted by the team and functional requirements were collected. The ASAP system was developed and various analysis engines were implemented to collect and calculate performance measures and provide diagnosis. Finally, the measures were communicated to the Dismounted Infantry Virtual After Action Review System (DIVAARS; Clark, Lampton, Martin, & Bliss, 2004) for display. The project resulted in a demonstration of the ASAP system to interested parties at the end of the period of performance.

PROBLEM

> *After Action Reviews (AARs) have proven to be the single most important event in collective training. This trend will continue as we progress into the 21st Century*
>
> -U.S. Army Training and Doctrine Command (1997)

The Army has established the After Action Review (AAR) as its primary mechanism for performance feedback following collective training events (Training Circular 25-20). Observer/Controllers (O/Cs) prepare for AARs by watching trainees execute tasks during the exercise and noting key incidents to be examined after the completion of the training mission. During the AAR, an O/C facilitates a discussion of what happened, why it happened, and how the unit could perform better in future analogous situations. Through open-ended questions, O/Cs encourage participants to analyze positive and negative outcomes of key actions in order to uncover dependencies and root causes. Both Blue and Opposition Forces participate in AAR at different levels of echelon (Morrison & Meliza, 1999).

Although the Army developed the AAR for live simulation, it is now applying the process to exercises conducted within virtual environments that simulate operational tools, tasks, entities, and terrain. While virtual environments cannot fully recreate the experience of being in an actual operational setting, they can construct situations that exercise the same skills of critical thinking, planning, communication, and coordination that are required for successful performance in the real world. Players demonstrate these skills by performing actions that change the status of their own simulated presence and/or that of other entities in the virtual world. These actions could entail the manipulation of physical controls analogous to those used in real-world interfaces (e.g., operation of a 9mm), or they could involve the generation of mouse/keyboard/joystick commands that direct the behaviors of a player's avatar within the simulated environment.

The use of virtual training technology creates both challenges and opportunities for the AAR. While the complexities of virtual environments complicate real-time observation of trainee behavior, platforms generally maintain event logs that can supplement human observation if raw data are synthesized into a human-consumable form. Similarly, while the distributed nature of virtual AARs limits the effectiveness with which participants communicate and interact, virtual AAR systems can support data visualizations that help to overcome these limitations. Automated technologies are only part of the solution, however; without careful customization of these technical capabilities to the requirements of the humans that use them, the training community will never realize the full potential of virtual AAR technologies.

There is a need for a system that facilitates rapid compilation of virtual AAR products. The system must leverage expert system technologies that enable flexible search and synthesis of simulation-based performance data, automatically classifying logged simulation play in terms of key Mission, Enemy Terrain, Troops and equipment, and Time available (METT-T) conditions. The system should provide automated support for determining the significance of search results to identify critical events for review, considering frequency, severity, relevance to mission orders, Rules Of Engagement (ROE), and training inputs. It should be capable of organizing

analytical conclusions into information structures that facilitate human understanding and support diagnosis of performance problems, and it should include tools that allow users to package the results of these searches into various formats that integrate seamlessly with sophisticated visualization capabilities such as the Army's Dismounted Infantry Virtual After Action Review System (DIVAARS). Ideally, such a system would include "how to fight" aids, as well, generating prescriptive feedback on correct reactions to simulation-specific events in some cases and providing links to reference documentation in others.

OBJECTIVE

The objective of this work was to build an ASAP prototype that demonstrated a number of core capabilities for assembling and delivering virtual AARs. The prototype interacts and uses the data model represented through Distributed Interactive Simulation (DIS) Protocol Data Units (PDUs) and enables the ready integration of ASAP with multiple simulation platforms. ASAP leveraged the Team Coaching Assistant for Simulation-Based Training (T-CAST) AAR technology that Aptima and BBN developed under the sponsorship of the Army Research, Development, and Engineering Command Simulation and Training Technology Center (RDECOM STTC). More specifically, the team re-used competency-based performance requirements that were mapped to data signatures of executable actions within a virtual environment to produce a list of significant events in the simulation from which to compute individual and team performance measures. ASAP also used technical functionality found within the Aptima A-Measure product suite to author performance measures, collect observer and system-based performance measurement data, and communicate with DIVAARS using web-service based communication protocols.

This work followed the basic AAR tool development process advocated by Meliza (1998): (1) decide what actions/information need to be presented to compare task execution with existing standards, (2) identify cues that mark the boundaries of tactical events to be examined, (3) determine what METT-T situation variables need to be analyzed/depicted, and (4) define appropriate methods for presenting/visualizing results. We also developed ASAP in accordance with Army training doctrine, studies of best practices in AAR technology use (e.g., Meliza, 1998; Morrison & Meliza, 1999), lessons learned reports from previous technology development efforts (e.g., Brown, Wilkinson, Nordyke, Riede, Huysoon, Aguilar, Wonsewitz, & Meliza, 1997), and guidance from Army SMEs with extensive experience performing and training irregular warfare operations.

METHOD/APPROACH

In this section, the methods and approaches that were used to develop the ASAP system are discussed. In summary, the approach that was used included: (1) the selection of a domain, (2) the creation of a scenario with associated training requirements and performance metrics, (3) the development of a system design, (4) the implementation and integration of various software components, (5) the demonstration and evaluation of the system. This project required significant effort in the area of software development and integration of components and those efforts will be explained in detail. This discussion will be broken down into the technical tasks that were performed and the method and approaches that were used during the execution of the tasks.

Task 1: Select Simulation and Domain. The ASAP project stakeholders, which included Aptima, BBN, MPRI, the Army Research Institute (ARI), and University of Central Florida Institute for Simulation and Training (IST), met and discussed possible simulation platforms to be used and incorporated into the ASAP project. These meetings took place over the beginning month of the contract. The candidate platforms included Forterra's OLIVE, Ambush, VBS2, RealWorld, and Research Network Inc.'s (RNI) Game DIS (GDIS). There were many factors that were evaluated during the selection of a simulation platform that included: applicability, extensibility, ease of use, and requirements for integration. It was also decided that the simulation platform should be based on the Distributed Interactive Simulation (DIS) standard for real-time distributed simulation.

Ultimately, the project stakeholders selected RNI's GDIS military training application. GDIS is based on the Valve Half-Life 2 commercial game engine. The use of commercial gaming technologies provides the Soldier with a mature high-fidelity 3D rendering that shortens the development cycle for building simulation software. This simulation supports multi-player distributed participation over standard internet connections. GDIS was developed for the U.S. Army as an integrated system for embedded training of Soldiers in immersive environments. The selection of GDIS was consistent with our goals to enhance the extensibility and interoperability of our solution and increase the integration opportunities with other military training systems and programs.

Figure 1 GDIS

The second decision made by the project stakeholders focused on the target domain for the exercise. At the suggestion of ARI, the team focused on a mixture of lethal and non-lethal squad-level tasks for dismounted infantry. Workshops were conducted and detailed overviews of lethal and non-lethal tasks performed during the movement-to-contact (MTC) battle drill were developed. During these workshops the Subject Matter Experts (SMEs) from MPRI reviewed and described the following topics: (1) standard infantry procedures, (2) event-based decisions that squad leaders make at different stages of a mission, (3) O/C methods for evaluating performance, and (4) techniques for informal and formal AARs. Initial scenario drafts based on the outcome of the workshops were developed and reviewed by all stakeholders. The scenario that was implemented in GDIS and used during the evaluation and demonstration can be found in Appendix A. The accompanying Operation Order (OPORD) can be found in Appendix B. Finally, a sketch depicting the scenario and execution of the OPORD for the specific geographic location of McKenna MOUT is included in Appendix C.

At the end of Task 1 the ASAP project team had selected a simulation environment for use in the development and integration of the ASAP system, and developed a notional scenario to be used in testing and evaluation of the ASAP system.

Task 2: Develop ASAP Requirements and Demonstration Plan. The objective of this task was to develop the list of requirements for the ASAP system, the scenario, and a plan for the proof-of-concept demonstration of the technology at the end of the project. The specific plan for conducting the demonstration is described in detail below.

First, the ASAP project team created and refined a scenario at a workshop held at ARI in Orlando, FL on 7 November 2007. Participants included representatives from Aptima, SMEs from MPRI, ARI, and IST. The scenario was broken down into four mission phases: (1) Plan, (2) Movement to Target, (3) Actions on Objectives, and (4) Exfiltration. The basic scenario involved the movement of a squad from a meeting point outside of the urban center into a designated area of the city. The squad searched buildings looking for a High Value Target (HVT). The squad apprehended the subject and proceeded to the meeting point outside of the city. To add some complexity, a sniper was in an unknown position and was able to randomly open fire on the squad. The table in Appendix D outlines the mission phases, tasks, standards, and notes on the scenario. The data developed by the SMEs for each task were used to inform the collection and calculation of performance measures to be collected during the execution of the mission in the GDIS simulation environment.

The second step in this task was to develop a set of requirements for the technology demonstration. Six high-level technical requirements were identified and are displayed in Table 1. These technical requirements will be explained in further detail in Task 3, Develop System.

Table 1. ASAP Technical Requirements

ASAP Technical Requirements
Collect data from GDIS simulation environment to inform performance measures.
Collect data from GDIS to inform calculation of BBN's visual/spatial measures.
Collect observer performance measures to supplement system-based measures.
Calculate performance measures using the Performance Measurement Engine.
Calculate visual/spatial measures using the BBN Spatial Engine.
Collate and communicate performance metrics to DIVAARS.

In the third and final step of task 2, Aptima developed both system-based and observer-based performance measures to assess the trainees during the execution of the identified scenario of capturing a HVT. The team combined information from several sources – performance theory, input from SMEs and task analyses, and knowledge of the scenarios to be used in training – to develop performance measures that had the potential to be reliably assessed. The first step in this process was to identify the most relevant set of squad level tasks, which are provided in Table 2.

Table 2. Squad Tasks

Squad Tasks
Squad Leader develops initial plan
Squad Leader requests additional intelligence
Squad Leader issues Request for Support (RFS)
Squad Leader communicates plan to squad
Squad rehearses mission
Squad Leader acknowledges need to perform equipment check
Squad crosses line of departure (IRP)
Squad navigates to mission objective
Squad executes traveling procedures
Squad executes traveling overwatch procedures
Squad maintains column formation
Squad maintains squad file formation
Squad applies safe movement techniques
Squad Leader indicates rally points
Squad Leader indicates need for communication check-in w/ Platoon Leader
Squad interacts with civilians In Accordance With (IAW) Rules Of Engagement (ROE)
Squad interacts with cultural landmarks IAW ROE
Squad rendezvous at Objective Rally Point (ORP)
Squad executes bounding overwatch procedures to objective
Squad Leader indicates squad would breach/kick down door
Entry team stacks in front of entry point (teams alternate entry/security)
Security team covers entry team (teams alternate entry/security)
Entry team clears room
Security team, Squad Leader enter cleared room
Squad interacts with occupants

Squad Tasks
Squad takes cover from combatant occupants
Squad returns fire
Squads halts and reorganizes
Squad executes bounding overwatch procedures to release point
Squad executes bounding overwatch procedures to ORP
Squad navigates to IRP
Squad executes traveling procedures
Squad takes cover
Squad returns fire
Squad out-briefs at IRP

The tasks identified in Table 2 provided the foundation for the MTC battle drill performance measures. Aptima worked with the MPRI SMEs on the development of meaningful and reliable system-based and observer-based measures of MTC operations. System-based performance measures are computed directly from data on the simulator's data bus or in the event database that was populated during the execution of the mission. These measures provide insight into aspects of the squad's performance that are difficult for humans to observe or report reliably, such as room clearing procedures or bounding overwatch maneuvers. The candidate set of system-based measures are displayed in Table 3.

Table 3. Candidate System-based Measures

Candidate System-based Measures
Does the High Value Target survive?
What percentage of casualties does the squad take?
Does the squad use a flashbang or grenade?
Does the squad perform an equipment check?
What is the latency between combatant fire and combatant injury or death?
Is the room occupied?
Threshold detection
Stack detection
Room clearing

In contrast, observer-based measures are specific measures rated by O/Cs about the squad's performance that are more difficult to assess automatically, such as adherence to communication protocols or teamwork skills. The candidate set of observer-based measures are provided in Table 4.

Table 4. Candidate Observer Measures

Mission Phase	Candidate Observer-based Measures
Plan	Does the Squad Leader outline essential tasks, roles and responsibilities, and timeline to accomplish all phases of mission?
Plan	Does the Squad Leader include observations concerning the enemy size, tactics, COA, and position?

Mission Phase	Candidate Observer-based Measures
Plan	Does the plan consider ROE for interaction with combatants and non-combatants during each mission phase?
Plan	Does the plan include primary, alternate, contingency, and emergency ingress/egress routes, including vehicle drop-off/pickup?
Movement to Target	Does the Squad Leader acknowledge need to perform equipment check?
Movement to Target	Does the squad cycle through equipment to check ammunition?
Movement to Target	Does the squad execute bounding overwatch procedures to objective?
Actions on Objective	Does the team employ flashbangs/grenades as appropriate and in accordance with ROE?
Actions on Objective	Does the team maintain collateral damage in accordance with ROE?
Exfil	Does the team use planned order of march, alpha/bravo alternate fires/movement, or use successive bounding?

The results of Task 2 included a scenario description, a set of functional requirements for the ASAP system, and a set of candidate performance measures to be developed during the execution of the project.

Task 3: Develop System and Implement Analysis Engine. Aptima and BBN conducted a technical analysis to identify a feasible set of functional requirements and developed a detailed system design and functional specification to support these requirements. The team then began the development of the ASAP system. The development of the system was broken down into 5 technical steps that will be described below.

Step 1: Captured Data from GDIS

Distributed Interactive Simulation (DIS) is a government/industry initiative to define an infrastructure for linking simulations of various types at multiple locations to create realistic, complex, virtual worlds for the simulation of highly interactive activities. The DIS standard defines the format and semantics of the messages that are exchanged between the simulations as Protocol Data Units (PDUs). PDUs provide information concerning the simulated entity states, the types of interactions that take place in a DIS exercise, and data for management and control of a DIS exercise. The ASAP project uses a DIS simulation environment called Game DIS (GDIS). GDIS is the simulation environment that ASAP connected to for the purpose of calculating and communicating performance measurements. The first technical objective was to build on a common component developed by Aptima to collect and capture data from simulation environments. The common component was already capable of collecting data from High Level Architecture (HLA) environments. The requirement was to now collect the same type of data from DIS. Therefore, the first step of the system development was to add functionality to the common data collector to capture DIS data. As mentioned above, DIS communicates via PDUs. The software opens a port, captures PDUs, and then subsequently stores them in the database. The common component is illustrated in Figure 2. The developed component is called the DIS Connector and it was developed in the form of a Dynamic Link Library (DLL). A DLL is a software component that contains a collection of small programs or functionality which can be called upon when needed by other software modules or executable programs. The DIS Connector performs the work of connecting, subscribing, and storing PDU packets to a database that then is used by another component to calculate performance metrics.

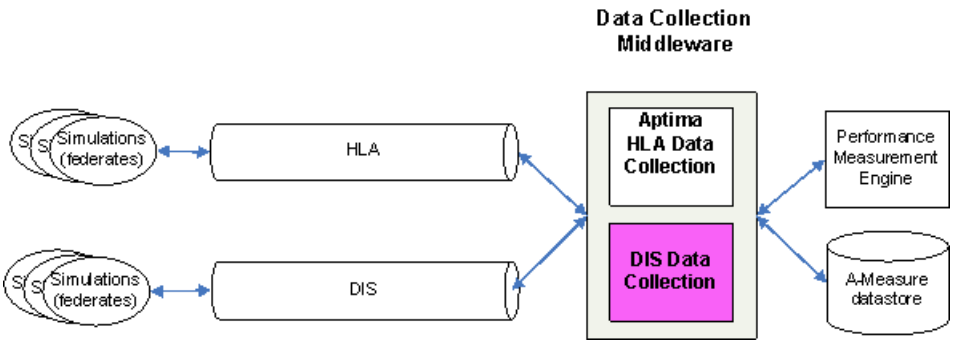


Figure 2 . Generic Data Collector Architecture

Step 2: Identified available data inputs and selected list of measures

The second technical objective of this task was to identify the available data communicated by the GDIS simulation and select a list of measures that can be calculated given the available data elements. The first step in this task was to identify the types of PDU packets that are produced by the GDIS simulation during play. The next step was to analyze and validate the data points that are contained within the available PDU packets. The last step was to compare the data points required for each individual measure with the list of identified data that is coming from the simulation and select a list of measures for implementation. Table 5 is a list of PDU types that were collected from the GDIS and BBN components and were used by the ASAP system to calculate results for display in DIVAARS.

Table 5 . PDU Types

PDU Types
EntityStatePDU
FirePDU
SignalPDU
CommentPDU

The work required in step 2 heavily utilized a set of tools that Aptima refers to as A-Measure. Two components of A-Measure that were utilized in ASAP were the Performance Workbench (PWB) and Performance Measurement Engine (PM Engine). PWB is a graphical interface that allows researchers to easily create measures from various types of simulator data. The PM Engine is the component that connects to a simulation data source, gathers and stores raw data, interprets the data, and computes and outputs measurements. Both components are described in detail below.

Creating measures from simulator data traditionally has been a time-consuming endeavor, requiring the knowledge of a domain subject matter expert, expertise in instructional design, and the skills of a software engineer. Aptima's PWB provides a graphical interface that enables researchers and trainers to specify and implement measures using simulator data quickly and easily, without the need for programming skills. The subsequent measures are automatically saved in Human Performance Markup Language (HPML), a format that allows the PM Engine to calculate the results of these measures from simulator data, either in real-time (i.e., during training) or after the training session is over (i.e., using saved data or log files). Based on the XML programming standard, HPML was designed to express performance measurement concepts in a format that is both universally machine-readable and easily decipherable by humans (Stacy, Ayers, Freeman, & Haimson, 2006). Figure 3 shows an example of a performance measure implemented in HPML. This measure calculates the percentage of enemy tanks destroyed. PWB was used to specify and implement selected system-based and observer-based measures selected from the list developed in step 1.

```
<Measurement ID="PercentageOfEnemyTanks">
   <Description>What percentage of enemy tanks was killed?</Description>
   <TrainingObjective>Tactical Navigation</TrainingObjective>
   <MeasurementComputation Operator="PROPORTION">
    <MeasurementComputationRef Ref="NumberOfEnemyTanks" />
    <MeasurementComputationRef Ref="EnemyTanksDestroyed" />
   </MeasurementComputation>
</Measurement>

<Measurement ID="EnemyTanksDestroyed">
   <Description>Count the number of enemy tanks that were destroyed</Description>
   <Parameter Name="MilitaryGroundVehicle1_1" Type="ParameterRef" />
   <MeasurementComputation Operator="IDENTITY" Aggregator="COUNT">
    <MeasurementComponentRef
      Ref="MilitaryGroundVehicle1_DamageState"
      ParameterRef="MilitaryGroundVehicle1_1" Logic="ALL" />
   </MeasurementComputation>
  </Measurement>

<MeasurementComponent ID="MilitaryGroundVehicle1_DamageState">
    <DataSourceQuery
      DataSourceRef="HLADB"
      From="ObjectRoot.PhysicalEntity.MilitaryEntity.MilitaryPlatform.MilitaryGroundVehicle"
      Select="DamageState"
      Where="@ID=%ParameterRef and DamageState=Destroyed" />
</MeasurementComponent>
```

Figure 3. Sample HPML describing a performance measure that determines the percentage of enemy tanks killed.

HPML allows the PM Engine to calculate the meta-data associated with each measure and allows system- (or simulator-) based measures to be more readily associated with other types of measures, such as observer-based or neurophysiological measures. Furthermore, PWB allows the user to define standards, or assessments, associated with each measure, thus facilitating subsequent data analysis. In addition to utilizing standard performance categories based solely on the resulting performance data, the user-defined assessments may also use contextual, or environmental, conditions present within the scenario to determine how a specific measurement is interpreted. Figure 4 shows the PWB main screen, which is the starting point for developing a new measure, modifying an existing measure, and selecting those measures that the user wishes to incorporate into data collection.

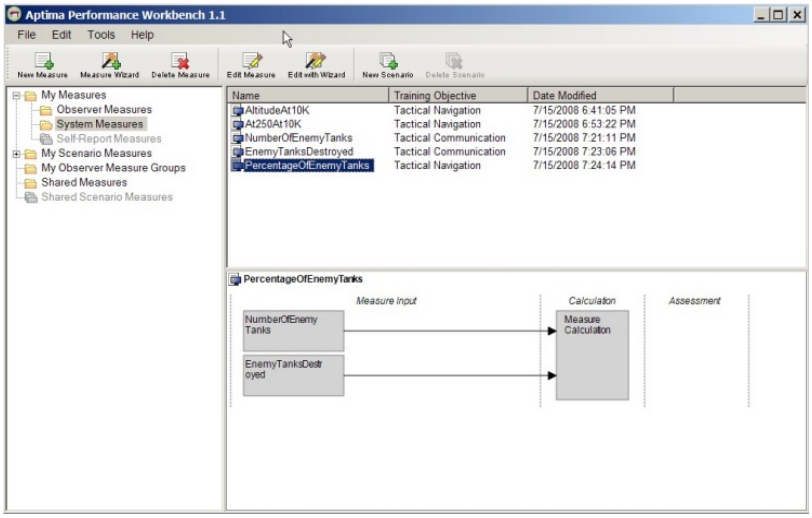


Figure 4. PWB main screen.

Step 3: Introduced an observer-based component to the ASAP solution

The third step was to identify a set of observer-based measures that are used by the O/Cs to record performance. We investigated different approaches to utilizing the measures in increasing complexity. The end result is a set of measures implemented in the SPOTLITE application that the O/Cs will use to record performance during the execution of a mission in GDIS. SPOTLITE is an easy-to-use application that runs on a hand-held Tablet PC. A screen shot of the SPOTLITE MOUT application is displayed in Figure 5. The measures will be communicated to the PM Engine during the mission and combined with the system measures and communicated to DIVAARS for After Action Review (AAR).

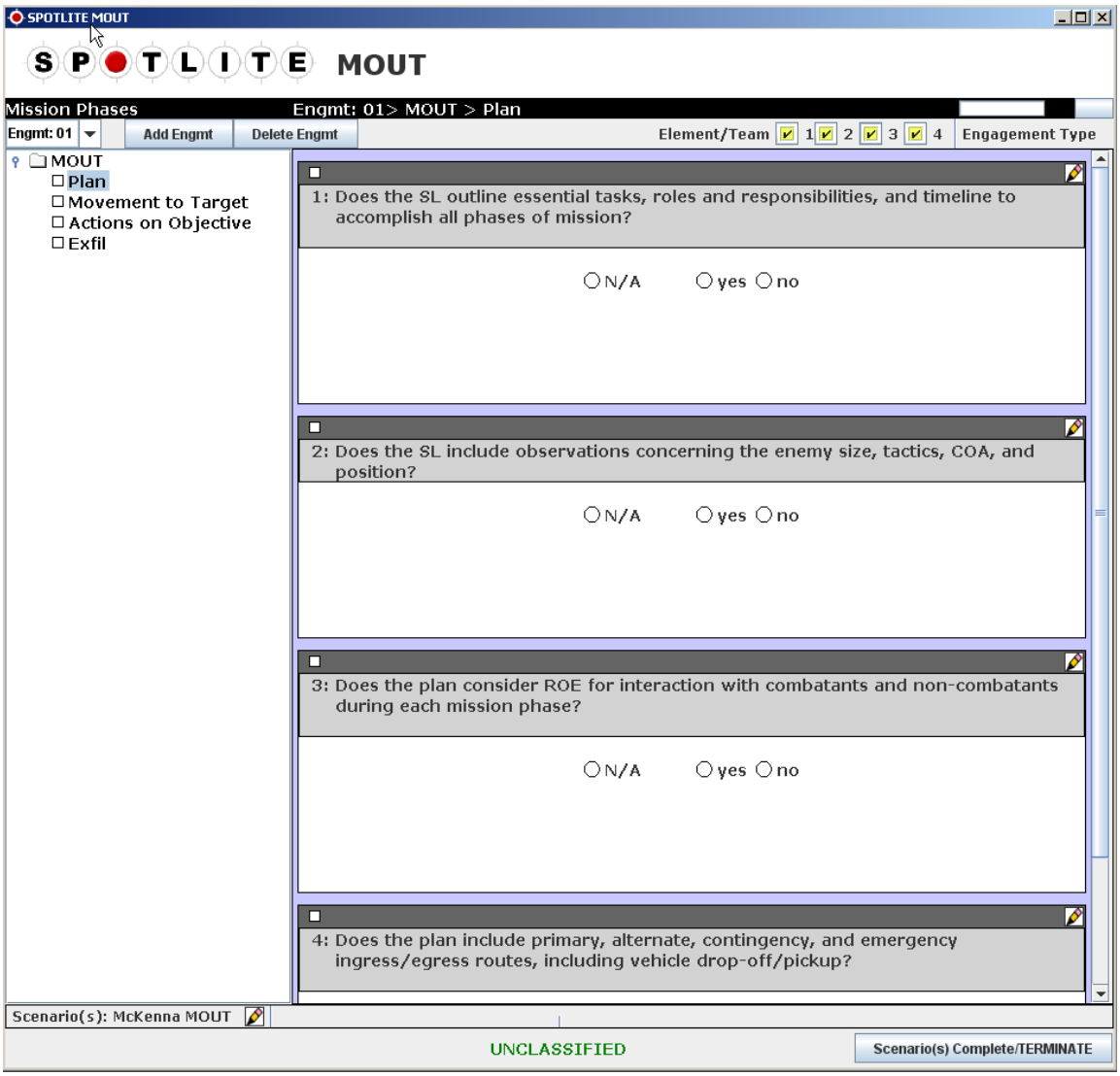


Figure 5. MOUT SPOTLITE

Step 4: Communicated with BBN to collect position/visualization analysis

The fourth step was to integrate performance measures that BBN developed with the ASAP system via the DIS Connector and PM Engine described in steps 1 and 2. The BBN module collected PDUs from the GDIS environment and attempted to calculate position and visualization measurements in a 3D space such as: threshold detection, stack detection, and whether or not room clearing occurred. Threshold detection is a marker which reports when an entity crosses marked thresholds in the simulation environment. In the scenario these were doorways in the building in which the High Value Target was located. In future scenarios these could be any line that is crossed in the environment. The BBN module then published the resulting measures onto DIS via a Comment PDU type and the PM Engine collected and stored

this information in the A-Measure database. The architecture of the BBN component is illustrated in Figure 6.

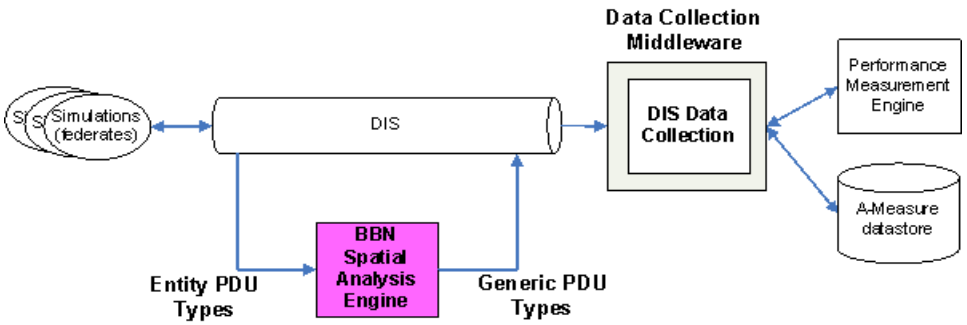


Figure 6. BBN Spatial Analysis Engine Integration

Step 5: Implemented list of predetermined measures and integrate components

The fifth step of this task included: (1) implementing selected measures from Task 2 in the PM Engine, (2) integrating the SPOTLITE observer measures, and (3) integrating the BBN position measures into the A-Measure database.

The first thing was to implement the selected system-based measures defined in PWB in Task 2 in the PM Engine. The PM Engine is illustrated in Figure 7. It is comprised of three main components. The first component is a web service interface that is used to accept and receive measurement definitions and requests for measurements in the form of human performance measurement language or HPML. The second component is a set of data source adapters. The data source adapters are used to exchange data between a source, such as a desktop simulator, and the performance measurement engine. The third component is the performance measurement engine. This is the heart of the application that interprets the measurement requests and performs the calculations on data the application is collecting through the data source. The implementation process was to take the HPML produced by PWB in step 2 and test it in the PM Engine to ensure that the calculations that already existed in the PM Engine supported the expected results. The decision was to write a new function called proportion which enabled more accurate results. The next step was to test that the web-service interface collected the observer-based measures and stored them accurately to the database. The final integration step was to parse and interpret the Comment PDU which contained the BBN position measures and store that to the database.

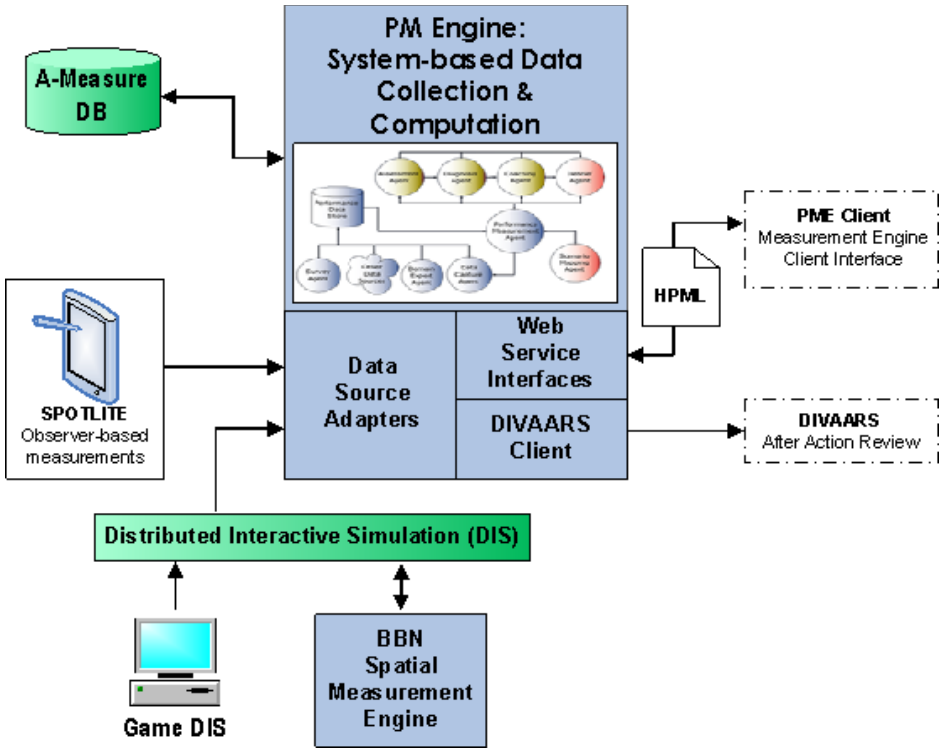


Figure 7. PM Engine within ASAP System Architecture

Task 4: Integrate ASAP System with DIVAARS. Aptima worked with representatives at IST to develop a communication mechanism within the PM Engine software application that could send the performance measurement results collected during the exercise to the DIVAARS system for use in an AAR. Aptima developed procedures for assembling the results of ASAP analyses into usable data formats capable of being sent to DIVAARS, as well as a set of policies that enable ASAP to recommend critical events/assessments and display formats for O/Cs to incorporate within their AAR presentations. The PM Engine Client screen is illustrated in Figure 8. The bottom right hand side of the application contains two buttons: (1) Send Table to DIVAARS and (2) Send to DIVAARS. These buttons are the mechanism that was used to send either a tag event for display or a table of events for display within DIVAARS.

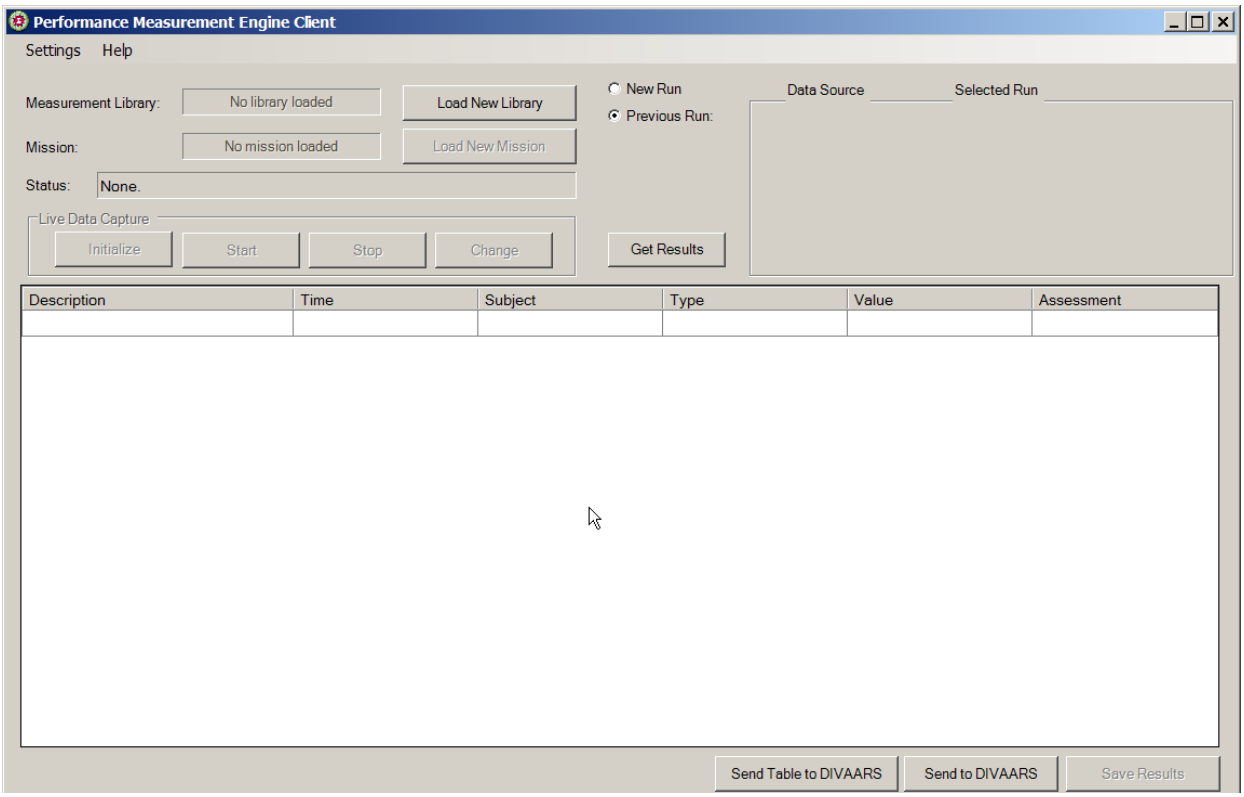


Figure 8. Performance Measurement Engine Client

These buttons format data into XML strings so that the PM Engine can communicate to DIVAARS in the form of TCP/IP messages. DIVAARS provides a remote communication capability that allows other analysis tools to provide information to DIVAARS for use during the review session. The PM Engine analyzed the session and determined aspects of the exercise that should be discussed during the review. As stated above, DIVAARS opens a TCP connection on port 3989 and listens for connections. The following XML message, illustrated in Figure 9, is an example of a message that was sent from the PM Engine to DIVAARS during system testing.

```
<?xml version="1.0">
<socratesxml version="1.0">
<tag>
    <simtime>
      <minutes>0</minutes>
      <seconds>30</seconds>
    </simtime>
   <description> Does the High Value Target Survive?</description>
   <source>PM Engine</source>
   <entitymarking>HVT</entitymarking>
   <tagtype>pass</tagtype>
   <viewpoint>
      <position>
          <x>1042.37</x><y>926.97</y><z>1477.05</z>
      </position>
```

```
      <orientation>
          <psi>0.0</psi><theta>0.0</theta><phi>0.0</phi>
      </orientation>
   </viewpoint>
   </tag>
</socratesxml>
```

Figure 9. PM Engine Tag Event Sent to DIVAARS

RESULTS

The results of this effort culminated in a demonstration of the ASAP system on August 6, 2008 in the laboratory at IST. Aptima, IST and ARI participated in the demonstration. Various members of the ARI and UCF staff attended. During the demonstration, members of the ASAP extended team ran the HVT scenario in the GDIS simulated environment and collected performance measures. Figure 10 outlines the flow of data and the different system components that were exercised during the demonstration.

1. GDIS published DIS PDU packets during the demonstration.
2. BBN collected PDU packets, calculated visual measures, and published the results to DIS as Comment PDU packets.
3. Aptima's DIS data collector captured PDU packets from GDIS and BBN and stored the PDU data to a database.
4. An O/C used Aptima SPOTLITE MOUT to record observer measures during demonstration. The observer-based measures were communicated via a web service to the PM Engine.
5. PM Engine calculated measures, integrated BBN and SPOTLITE measures, and converted the measure results to XML messages.
6. XML messages were sent to DIVAARS for use in the replay and After Action Review.

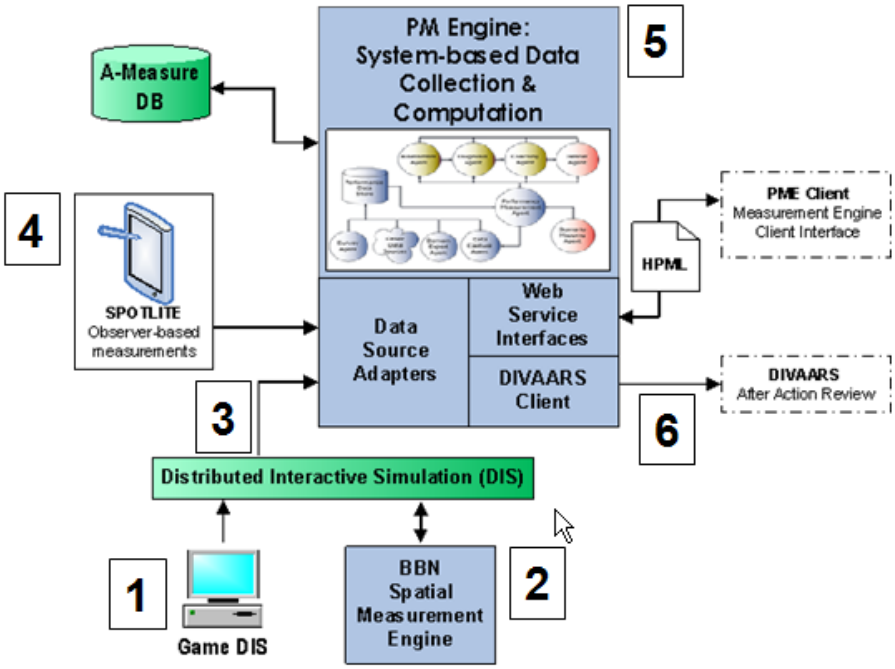


Figure 10. ASAP system diagram illustrating data flow and processes.

The following measures displayed in Table 6 were calculated during the demonstration.

Table 6. Measures collected during demonstration.

Measures collected
Does the High Value Target Survive?
What percentage of casualties does the squad take?
Was the room occupied?
Was and when was the room cleared?
Does the Squad Leader outline essential tasks, roles and responsibilities, and timeline to accomplish all phases of mission?
Does the Squad Leader include observations concerning the enemy size, tactics, COA, and position?
Does the plan consider ROE for interaction with combatants and non-combatants during each mission phase?
Does the plan include primary, alternate, contingency, and emergency ingress/egress routes, including vehicle drop-off/pickup?
Does the Squad Leader acknowledge need to perform equipment check?
Does the squad cycle through equipment to check ammunition?
Does the squad execute bounding overwatch procedures to objective?
Does the team employ flashbangs/grenades as appropriate and in accordance with ROE?
Does the team maintain collateral damage in accordance with ROE?
Does the team use planned order of march, alpha/bravo alternate fires/movement, or use successive bounding?

Overall, the demonstration verified that the technology integration among the various technical components described above was completed and operated as designed. The performance measures were calculated and they flowed into the DIVAARS system for presentation during the simulated AAR. The audience was engaged and asked questions about the benefits of our approach.

CONCLUSION

The main objective of this project was to develop a technology for AARs that would advance the range of existing analysis and add flexibility with which it can be used to add instruction and insight for O/Cs conducting training exercises. The ASAP project resulted in three primary products: (1) sets of system and observer-based performance measures for MCT scenarios, (2) functional prototypes of PM Engine and SPOTLITE data collection instruments, and (3) a scenario developed by SMEs to train MTC TTPs. Along the course of the project, there were challenges that included insufficient data to inform some of our system-based measure calculations. Also, the work to adapt parameters for BBN's 3D analysis engine to the DIS representation of objects in space was underestimated which resulted in limited 3D analysis to support certain performance metrics such as stack detection.

Overall, the ASAP team met the technical objectives that were outlined at the start of the project. The technical objectives included: (1) the selection of GDIS and the MTC domain, (2) the creation of a scenario focusing on the acquisition of a High Value Target (HVT) with associated training requirements and candidate performance measures, (3) the development of a system design, (4) the implementation and integration of the ASAP software, and (5) the integration of the performance measures with DIVAARS.

REFERENCES

Brown, B. R., Nordyke, J. W., Gerlock, D. L., Begley, I. J., & Meliza, L. L. (1998, May). Training analysis and feedback aids (TAAF Aids) study for live training support (Study Report, Army Project Number 2O665803D730). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Clark, Bryan R., Lampton, Donald R., Martin, Glenn A., Bliss, James P. (1998). User Manual for the Dismounted Infantry Virtual After Action Review System (DIVAARS) (User Manual).

Freeman, J., MacMillan, J., Haimson, C., Weil, S., Stacy, W., & Diedrich, F.J. (2006). From gaming to training. Proceedings of the Society for Applied Learning Technologies, Orlando, FL.

Freeman, J., MacMillan, J., Haimson, C., Weil, S., Stacy, W., & Diedrich, F. J. (2006). Strategies and studies in game-based training. Proceedings of the Society for Applied Learning Technologies, Orlando, FL.

Lampton, D. R., Cohn, J. V., Endsley, M. R., Freeman, J., Gately, M. T., & Martin, G. A. (2005). Measuring situation awareness for dismounted infantry squads: Automated assessment and feedback strategies. Proceedings of the Human Factors and Ergonomics Society 49th Annual Meeting. Santa Monica, CA: HFES.

Morrison, J. E., & Meliza, L. L. (1999). Foundations of the after action review process (Special Report 42). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Stacy, W., Ayers, J., Freeman, J., & Haimson, C. (2006). Representing human performance with Human Performance Measurement Language (HPML). Proceedings of the Interservice/Industry Training, Simulation and Education Conference. Arlington, VA: NDIA.

Stacy, W., Merket, D., Puglisi, M., & Haimson, C. (2006). Representing context in simulator-based human performance measurement. Proceedings of the Interservice/Industry Training, Simulation and Education Conference (I/ITSEC). Arlington, VA: NDIA.

Stacy, W., Merket, D., Freeman, J., Wiese, E., & Jackson, C. (2005). A language for rapidly creating performance measures in simulators. Proceedings of the Interservice/Industry Training, Simulation and Education Conference (I/ITSEC). Arlington, VA: NDIA.

Stacy, W., Ayers, J., Freeman, J., & Haimson, C. (2006). Representing human performance with Human Performance Measurement Language (HPML).

Proceedings of the Interservice/Industry Training, Simulation and Education Conference. Arlington, VA: NDIA.

APPENDIX A. DOMAIN SPECIFIC SCENERIO

You are the Squad Leader of 1st Squad, 1st Platoon, Company A. The rifle squad has one squad leader, two fire team leaders, two automatic riflemen, two riflemen, and two grenadiers. The rifle platoon consists of a platoon headquarters, three rifle squads, and a weapons squad. There are two machine gun teams and two anti-armor teams in the weapons squad. Each machine gun team and anti-armor team consists of a gunner and an assistant gunner.

(Change squad/platoon strength if the squad/platoon is missing members due to illness/injury or just vacant positions)

1ST Platoon, Company A is operating from Forward Operating Base (FOB) Tango. Company A has been conducting operations throughout their Area of Operation (AO) for three months. In the AO is the town of Hudna with approximately 60% of the civilian population still in the city. The civilians are not openly hostile to host country and U.S. forces; however there may be insurgent and al Qaeda supporters. Recently there have been reports of insurgent/al Qaeda operatives observed in the vicinity of the town. Company A has been in this town several times in the previous months conducting cordon and search missions and vehicle control points.

A five man Scout team has been reconning the area. They have reported the presence of a high value target (HVT), an al Qaeda operative (Karim al-Jazim). The Battalion Commander has given Company A the mission of capturing the high value target. The company Commander has assigned the mission to 1st Platoon.

The platoon leader has issued the following oral Warning Order (WARNORD):

1st Platoon WARNORD

"1st Platoon's mission is to capture a high value target named Karim al-Jazim. He is located in the town of Hudna and will be in that location until 0630 tomorrow. Battalion Scouts have the town under observation and will remain on site until the mission is complete. We will depart by 5 ton to a dismount point and then move by foot to the objective. 1st Squad will be the breach element, 2nd Squad will be security, 3rd Squad and 4th Squad will be in support with the 2 M240s. The OPORD will be given here at 1600."

You are the 1ST Squad Leader. You have given the squad a WARNORD based on the platoon WARNORD.

Once you are issued the platoon OPORD you will be required to issue a squad OPORD.

(Insert/present platoon OPORD)

TASK: Issue an Oral Squad Operation Order (OPORD)

CONDITION: Provided a platoon OPORD and the requirement to develop and issue an oral squad OPORD

STANDARD: Within 30 minutes developed and issued a clear and brief Squad OPORD based on the platoon OPORD. Issue the OPORD in the 5 paragraph format using standard military terminology.

Performance Measures	**GO**	**NO GO**
1. Issued an oral squad OPORD within 30 minutes.	____	____
2. Issued the OPORD in 5 paragraph format and used standard military terminology.	____	____
3. Included all available information made sure that all understood their mission and instructions.	____	____

Evaluation Guidance: Score the Soldier GO if all performance measures are passed. Score the Soldier NO GO if any performance measure is failed. If the Soldier fails any performance measures, show what was done wrong and how to do it correctly.

After successfully issuing your OPORD, 1st squad will begin their movement to the objective from the ORP.

APPENDIX B: OPORD FOR SCENARIO

Copy 1 of 1 copies
1st Platoon
FOB TANGO
011500NOV07
001

OPERATION ORDER 1-07

Time Zone Used Throughout the Order: Local

TASK ORGANIZATION
1ST Platoon
- 1st Squad
- 2nd Squad
- 3rd Squad
- 4th Squad (2x M240 MGs)
- Medic (2)
- Transportation Section (2x M1025 HMMWV) (3xM939 5 ton)

1. SITUATION

a. Enemy Forces. Battalion S2 reports that a high value target (HVT), Karim al-Jazim, has been sighted by a Battalion Scout team in the town of Wasabi.

(1) Disposition, composition, and strength. The HVT has been staying in a small one story building on the Northeast corner of the town. There are possibly 3 non-combatant/civilians living in the building that are friendly with the insurgents.

(2) Capabilities. Karim al-Jazim is probably armed and some of the other occupants of the building may be armed. Sniper fire and IEDs may be encountered.

(3) Most probable course of action. Karim al-Jazim will probably attempt to evade capture by all means. Once presence is discovered expect to receive direct fire from nearby buildings.

b. Friendly Forces.

(1) Higher unit. Company A will continue to conduct operations from FOB.

(2) Left unit's mission. 2nd Platoon will continue to conduct presence patrols in their area of operations.

(3) Right unit's mission. Company B is establishing vehicle check points in their area of operations.

(4) Front unit's mission. A five man Scout team has observation on the Northeast corner of the town.

(5) Unit providing fire support. 1st Battalion 101 Aviation is providing 2 AH-64 Apaches with a 10 minute reaction time.

c. Attachments and detachments.

(1) Medical platoon will provide two medics.

(2) Transportation Section of the Support Platoon will provide three 5 ton trucks and 2 gun vehicles for security.

(3) Battalion will provide one interpreter.

2. Mission. 1st Platoon will conduct a raid at the building located in the Northeast corner of the town of Hudna to capture Karim al-Jazim NLT 0430.

3. Execution.

Intent. My intent is to apprehend Karim al-Jazim with as much force is necessary and with respect to the civilians in the area, avoiding collateral damage as much as possible, evacuate the high value target and return to the FOB by vehicle.

a. Concept of the Operation. 1St Platoon will mount three 5 tons accompanied by two gun vehicles and depart FOB TANGO at 0130 moving South along route Charlie to a position approximately 1000 meters from the town, that will be the link-up point with the Scouts, Scout team members will guide the vehicles into an assembly area. The platoon will dismount and organize into a traveling formation, squads in column and move on an azimuth of 165 degrees for approximately 800 meters and occupy the Objective Rally Point (ORP) by force. The platoon leader will issue a five point contingency plan and then go forward with the Scouts to their observation post to conduct the leader's recon. Upon return to the ORP he will provide any additional information and then the squads will move out to the objective. After actions on the objective the squads will return to the ORP, report to higher and call for the vehicles to come forward for pick-up.

(1) Maneuver. (See ANNEX A) After the leader's recon, 3rd Squad will move to the West with a Scout to a position that allows them to cover the roads to the West of the target and buildings A2, B1 and C3. 4th squad will move to Southeast to the Scout observation point to cover the roads to the East of the target and buildings C1, C2, and C3 and provide supporting fires if necessary. 1st and 2nd squads will move forward after 3rd and 4th are in position, 2nd squad will move to locations West and South of building A1 to provide security and isolate building A1. 1st Squad will assume position to breach the door. After all elements report to the platoon leader they are in position, the platoon leader will signal 1Sst Squad to breach the door and clear the building, secure the HVT and segregate and secure all other personnel in the building. After the HVT identity is confirmed, we will report to higher and call the vehicles for extraction. 1st

Squad will commence movement back to ORP with 2nd Squad providing security, on command 2nd Squad will move toward the ORP. 3rd and 4th Squads will remain in their support positions until all squads are in the ORP and the trucks have arrived. As the squads arrive in the ORP we will establish a perimeter and wait for the vehicles.

(2) Fires. AH-64's will be on call and engage targets to cover the withdrawal from the target.

b. Tasks to maneuver units.

(1) Assault/Breach element is 1st Squad. Make sure breach charges are prepared if needed and flex cuffs to detain the HVT.

(2) Cordon security element is 2nd Squad. Draw additional smoke grenades to cover the withdrawal if necessary. Be prepared to assume the breach if 1st Squad needs assistance.

(3) Support element is 3rd and 4th Squad. Draw additional smoke for the M203's.

(4) 3rd Squad will provide two members for ORP security.

(5) The medic's will remain in the ORP and establish the Casualty Collection Point..

c. Tasks to Combat Support Units. N/A

d. Coordinating Instructions.

(1) Vehicle mounting. 1st Squad will be on the first truck, 2nd Squad is on the second truck with the Platoon Leader, RTO and medics. 3rd and 4th Squads will be on the 3rd truck.

(2) Order of movement from the dismount point is 1-2-4-3.

(3) Time Schedule.
1700-1900 Draw Ammunition
1900-2000 Chow
2000-2400 Rehearsals
2400-0030 Pre-combat checks/ pre-combat inspections (PCC/PCI)
0030-0100 Convoy commanders Briefing
0100-0130 Mount vehicles
0130 Depart FOB
0430 Breach Time

OPORD 1-07 1ST PLATOON

(4) Rules of engagement. Permission to engage is not required if weapons are identified. Use of deadly force is only authorized if facing imminent danger.

4. Service Support.

Dinner meal will be a hot A in the FOB.
Top off canteens and camelbacks.
2nd Squad draw 2 HC smoke grenades per man.
3rd Squad draw 4 M18A1 Claymores.
4th Squad draw ten smoke grenades per M203s beside the standard load.
All other ammunition draw will be per SOP.
Casualty collection point will be in the ORP.
EPW collection point will be at the ORP area.

5. Command and Signal.

a. Command

(1) Company commander: Company commander will remain at FOB TANGO.

(2) Platoon Leader: Will travel with 2nd Squad during movement to the ORP and at the objective.

(3) Succession of command: Platoon Leader, Platoon Sergeant, 4th Squad Leader, 1st Squad Leader, 2nd Squad Leader, 3rd Squad Leader, then by date of rank.

b. Signal.

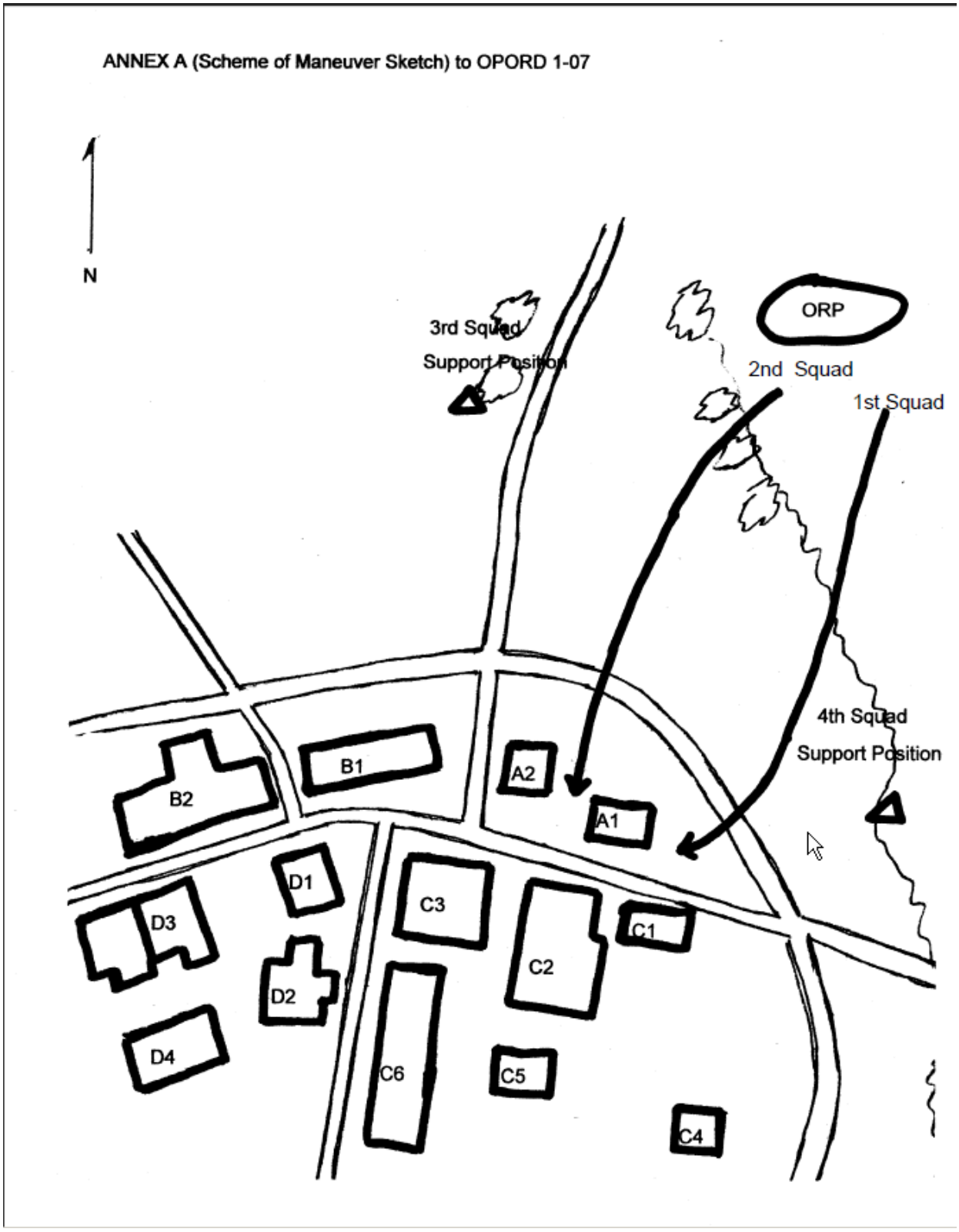
(1) Current SOI in effect.
(2) Traveling: Primary hand and arm. Alternate radio.
(3) Running password: Porky
(4) Number combination: 13
(5) Code name for HVT is Bojangles.

James K. Beam
Second Lieutenant

ANNEXES:

A. Scheme of maneuver Sketch

APPENDIX C: SKETCH OF OPORD



APPENDIX D: SCENERIO, TASK, and STANDARDS

PHASE	TASK	STANDARDS/ EXPECTATIONS	WHEN RELEVANT	NOTES
Plan	SL develops initial plan	Outlines essential tasks, roles & responsibilities, and timeline to accomplish all phases of mission IAW platoon OPORD	Initial planning	Expect the worst case scenario when planning. You could walk into a town that a insurgent cell decided to spend the night in. If excessive fires may bring in CAS or other units. If the summertime they may be sleeping on the roofs and open up on you. One variation will be to engage someone in the house. E12
Plan	SL develops initial plan	Includes observations re: enemy size, tactics, COA, positions	Initial planning	
Plan	SL develops initial plan	Plan considers ROE for interaction with combatants and non-combatants during each mission phase	Initial planning	Direct civilians to disperse outside, inside house follow search tactics, don't pick wrong house, know whether to knock vs. breach, deal w/ protesters
Plan	SL develops initial plan	Includes TTPs for room clearing	Initial planning	O/C could record team's stated clearing tactic
Plan	SL develops initial plan	Considers weapons/equipment available	Initial planning	

PHASE	TASK	STANDARDS/ EXPECTATIONS	WHEN RELEVANT	NOTES
Plan	PL develops initial plan	Incorporates map reconnaissance. Platoon leader does this.	Initial planning	O/C can observe whether SL consults map
Plan	SL develops initial plan	Identifies key terrain and addresses constraints, threats, obstacles to movement, and options for concealment	Initial planning	Position of cultural/land features (e.g., mosques, places of concealment for enemy ambush)
Plan	SL develops initial plan	Includes primary, alternate, contingency, and emergency ingress/egress routes, including vehicle drop-off/pickup	Initial planning	Considers need for secondary drop-off/pickup locations in case of obstruction (traffic, etc.). Also includes contingency transportation of suspect by foot.
Plan	SL develops initial plan	Accommodates vehicle constraints for designated drop-off/pickup sites	Initial planning	Size of ground vehicle, helicopter landing, etc.
Plan	SL develops initial plan	Considers time available and required for travel/task execution	Initial planning	
Plan	SL develops initial plan	Includes rally points (including initial and objective), locations for designated comm check in, casualty collection point within building, limit of advance, and release point	Initial planning	
Plan	SL develops initial plan	Includes adjacent unit coordination	Initial planning	E.g., positioning of SBF

PHASE	TASK	STANDARDS/ EXPECTATIONS	WHEN RELEVANT	NOTES
Plan	SL requests additional intel	Request information relevant to mission	Initial planning	e.g., is there a terrorist group w/ suicide tactics in area? How friendly are the locals - how will they act when we snatch suspect?
Plan	SL issues Request for Support (RFS)	Requests necessary, reasonable equipment	Initial planning	Transportation to/from IRP (including transport for suspect).
Plan	SL comm plan to squad	At least 2/3 pre-mission time still available	After completing initial plan	
Plan	SL comm plan to squad	Uses visual aids (map) to communicate plan	After completing initial plan	
Plan	SL comm plan to squad	Ensures all subordinates receive/understand orders	After completing initial plan	SL may quiz subordinates to determine whether they understand
Plan	Squad rehearses mission	Verbally step through key activities IAW timeline of events	After comm plan to squad	OC can point out problems in plan at this time
Plan	SL revises plan and communicates to squad	Modifications address shortfalls. Above task standards/ expectations continue to apply	If rehearsal uncovers missing/inconsistent elements	
Movement to Target	SL acknowledges need to perform equipment check	Verbally indicates need to verify ammo and comms	Before movement begins	
Movement to Target	Squad crosses line of departure (IRP)	Occurs at planned start time	Beginning of movement	

PHASE	TASK	STANDARDS/ EXPECTATIONS	WHEN RELEVANT	NOTES
Movement to Target	Squad navigates to mission objective	Follows planned ingress route(s)	Throughout movement to target	
Movement to Target	Squad executes traveling procedures	Maintains close distance between Soldiers	During movement within region in which enemy contact is unlikely	
Movement to Target	Squad executes traveling overwatch procedures	Maintains moderate distance between Soldiers (adjusted for weather)	During movement within region in which enemy contact is unlikely	
Movement to Target	Squad maintains column formation	Follows planned order of march	Whenever sufficient room to maneuver during traveling or traveling overwatch	
Movement to Target	Squad maintains squad file formation	Follows planned order of march	Whenever terrain funnels squad during traveling or traveling overwatch	
Movement to Target	Squad maintains squad file formation	Maintains sufficient spacing	Whenever terrain funnels squad during traveling or traveling overwatch	
Movement to Target	Squad applies safe movement techniques	Avoids windows, mouseholes, steps quickly/jumps to avoid basement-level windows/grates	Throughout movement when terrain conditions apply	
Movement to Target	Squad follows appropriate security procedures	Maintains coverage on front, sides, and rear, using overlapping sectors of fire. Pies off windows, doors, alleys, and mouseholes. Covers upper stories of buildings	Throughout phase when terrain conditions apply	Each Soldier monitors assigned sector, 120 degrees, overlapping sectors. Position in formation determines assigned sector.
Movement to Target	Squad follows appropriate security procedures	Avoids flagging teammate	Throughout movement and for remainder of mission	

PHASE	TASK	STANDARDS/ EXPECTATIONS	WHEN RELEVANT	NOTES
Movement to Target	SL indicates rally points	IAW plan	At planned rally points	
Movement to Target	SL indicates need for comm check-in w/ PL	IAW plan	At planned comm check-in points	
Movement to Target	Squad interacts with civilians IAW ROE	Follows cultural norms for addressing individuals, avoids pointing weapon/yelling at/shooting noncombatants.	If civilians are encountered along route	
Movement to Target	Squad interacts with cultural landmarks IAW ROE	Avoids entering/shooting at religious structures	If cultural landmarks are encountered along route	
Movement to Target	Squad rendezvous at ORP	Timing IAW plan	At ORP	
Movement to Target	Squad rendezvous at ORP	SL acknowledges need to check equipment, weapons, personnel	At ORP	
Movement to Target	Squad rendezvous at ORP	SL indicates need to comm/ supporting elements	At ORP	
Movement to Target	Squad rendezvous at ORP	SL indicates need to comm w/ PL that squad is in position and ready to commence actions on objective	At ORP	
Movement to Target	Squad executes bounding overwatch procedures to objective	Uses planned order of march, alpha/bravo alternate fires/movement or use successive bounding. SL stays w/ rear team. Accommodate intersections and other locations with heightened	Between ORP and house	

PHASE	TASK	STANDARDS/ EXPECTATIONS	WHEN RELEVANT	NOTES
		susceptibility to ambush		
Movement to Target	Squad executes bounding overwatch procedures to objective	Maintains large distance between Soldiers (adjusted for weather)	Between ORP and house	
Movement to Target	Squad executes bounding overwatch procedures to objective	Arrives at correct house	Upon arrival at house	
Movement to Target	Squad executes bounding overwatch procedures to objective	Arrives at planned time	Upon arrival at house	
Actions on Objective	SL indicates squad would breach/kick down door	Breaches/kicks down door instead of knocking given mission/ROE	Upon arrival at house	House is known location of enemy; breach is appropriate. If they see an Iraqi police officer enter that building the threat increases. May want to put a vehicle outside of the house and the target does not have a car. If the person in the house is hostile the infantry unit will kill him. They will respond to fire with overwhelming fire. Controlling the return fire is really difficult.

PHASE	TASK	STANDARDS/ EXPECTATIONS	WHEN RELEVANT	NOTES
Actions on Objective	Entry team stacks in front of entry point (teams alternate entry/security)	Assumes correct stacking positions (correct order, close to wall, side of door opposite hinge)	Before entering each new room in house, until suspect is apprehended or limit of advance is reached	
Actions on Objective	Security team covers entry team (teams alternate entry/security)	Provides constant 360 degree security for all entry points/unsecure positions	Before entering each new room in house, until suspect is apprehended or limit of advance is reached	
Actions on Objective	Entry team clears room	Follows planned clearing TTPs (buttonhook to designated locations, etc.)	Immediately after each stack until room is secure, until suspect is apprehended or limit of advance is reached	
Actions on Objective	Entry team clears room	Passes though fatal funnel quickly and makes room for teammates to enter	Immediately after each stack until room is secure, until suspect is apprehended or limit of advance is reached	
Actions on Objective	Entry team clears room	Room fully searched for potential combatants	Immediately after each stack until room is secure, until suspect is apprehended or limit of advance is reached	
Actions on Objective	Entry team clears room	Room cleared in timely manner	Immediately after each stack until room is secure, until suspect is apprehended or limit of advance is reached	
Actions on Objective	Entry team clears room	TL indicates need to mark room	Immediately after entry team clears room	

PHASE	TASK	STANDARDS/ EXPECTATIONS	WHEN RELEVANT	NOTES
Actions on Objective	Security team, SL enter cleared room	Room cleared before entry	Immediately after entry team clears room	
Actions on Objective	Squad interacts with occupants	Pats down both men and women per mission/ROE. Only pat down the women if you absolutely must. If you receive fire you can pat women down to a degree. This is a critical event. May bring along a female interpreter or a female Soldier.	After room is cleared and upon encountering non-combative occupants or subduing combative occupants	House is known to contain enemy
Actions on Objective	Squad interacts with occupants	Segregates men from women. Moves occupants to central location, separates, and prevents communication. Need an EPW collection point. Anyone carrying a weapon will go to an EPW collection point which is often outside the building.	After room is cleared and upon encountering non-combative occupants or subduing combative occupants	Casualty collection point is usually at the ORP.
Actions on Objective	Squad interacts with occupants	Provides constant coverage	After room is cleared and upon encountering non-combative occupants or subduing combative occupants	
Actions on Objective	Squad takes cover from combatant occupants	Squad members quickly assume positions of cover that protect from perceived enemy locations. Rush should take NMT 5 sec.	Enemy contact within house	Determine time lag between fire event and assumption of covered position. Measure involves calculating percentage of

PHASE	TASK	STANDARDS/ EXPECTATIONS	WHEN RELEVANT	NOTES
				body open to fires + determining logically possible/probable locations of attack.
Actions on Objective	Squad returns fire	Shoots to kill	Enemy contact within house; combatant is not suspect	
Actions on Objective	Squad returns fire	Shoots to disable	Enemy contact within house; combatant is suspect	Often not sure who the high value target is. If shooting starts the target will probably get killed. In a scenario put him in the house with his wife. If it is al Qaeda then he will put up a fight.
Actions on Objective	Squad returns fire	Limits collateral damage to non-combatant	Enemy contact within house	If you take fire from another building do not bring the building down because you do not know who is firing on you (i.e. police chief in his house).
Actions on Objective	Squads halts and reorganizes	Moves casualties to designated casualty collection point	Reach limit of advance or suspect apprehended	
Actions on Objective	Squads halts and reorganizes	SL indicates need to request ACE report from TLs	Reach limit of advance or suspect apprehended	
Exfil	Squad moves suspect to rendezvous with transport vehicle at the	Arrives at planned location	After leaving house and until suspect is in transport vehicle	

PHASE	TASK	STANDARDS/ EXPECTATIONS	WHEN RELEVANT	NOTES
	ORP			
Exfil	Squad moves suspect to rendezvous with transport vehicle	Arrives at planned time	After leaving house and until suspect is in transport vehicle	This is typically at the ORP. You want to get in and out quickly because the opposition will be increasing. Move suspect to rendezvous with the vehicles at the release point. If you have taken fire the transportation will not come up to the building. A couple of 5-ton trucks, an ambulance, and a HUMVEE.
Exfil	Squad moves suspect to rendezvous with transport vehicle	Surrounds suspect and provides security/fires to subdue attackers	After leaving house and until suspect is in transport vehicle	May have an LZ and pick him up by helicopter. May get him and his family to protect him because he is a source. He would likely want to bring his extended family. Only one or two people would approach the house but a platoon would likely be available.

PHASE	TASK	STANDARDS/ EXPECTATIONS	WHEN RELEVANT	NOTES
Exfil	Squad executes bounding overwatch procedures to release point	Uses planned order of march, alpha/bravo alternate fires/movement or use successive bounding. SL stays w/ rear team. Accommodate intersections and other locations with heightened susceptibility to ambush	From suspect transport rendezvous point or house to release point	
Exfil	Squad executes bounding overwatch procedures to release point	Maintains large distance between Soldiers (adjusted for weather)	Between house and planned release point	
Exfil	Squad executes bounding overwatch procedures to ORP	Uses planned order of march, alpha/bravo alternate fires/movement or use successive bounding. SL stays w/ rear team. Accommodate intersections and other locations with heightened susceptibility to ambush	Between release point and ORP	
Exfil	Squad navigates to IRP	Follows planned egress route(s)	Between ORP and IRP	
Exfil	Squad executes traveling procedures	Maintains close distance between Soldiers	Between ORP and IRP	

PHASE	TASK	STANDARDS/ EXPECTATIONS	WHEN RELEVANT	NOTES
Exfil	Squad takes cover	Squad members quickly assume positions of cover that protect from perceived enemy locations. Rush should take NMT 5 sec.	Enemy contact	Determine time lag between fire event and assumption of covered position. Measure involves calculating percentage of body open to fires + determining logically possible/probable locations of attack.
Exfil	Squad returns fire	Shoot to kill combatants	Enemy contact	
Exfil	Squad returns fire	Limit collateral damage to non-combatants and religious structures per ROE	Enemy contact	
Exfil	Squad outbriefs at IRP	Relates all relevant/necessary information	IRP	